iPORT™ PT1000-CL4 External Frame Grabber
User Guide

Pleora
Technologies

Table of Contents

Chapter 1

About this Guide

This chapter describes the purpose and scope of this guide and provides a list of complimentary guides.

The following topics are covered in this chapter:

- "What this Guide Provides" on page 2
- "Related Documents" on page 2

What this Guide Provides

This guide provides you with the information you need to connect the iPORT PT1000-CL4 External Frame Grabber to a Camera Link® Base camera. In this guide you can find a product overview, instructions for connecting the cables, installing the Pleora eBUS™ SDK, establishing an Ethernet connection, and performing general configuration tasks.

The last chapter of this guide provides Technical Support contact information for Pleora Technologies.

This guide covers the GigE Vision® compliant PT1000-CL4 External Frame Grabber.

The PT1000-CL5 External Frame Grabber, which is not GigE Vision compliant, is covered in the *PT1000-CL Hardware Guide for Vision SDK*, available on the Pleora Support Center.

Related Documents

The *iPORT PT1000-CL4 External Frame Grabber User Guide* is complemented by the following guides:

- *GEVPlayer Quick Start Guide*
- *GEVPlayer User Guide*
- *eBUS SDK Programmer's Guide*
- *GigE Vision Standard*, version 1.2 available from the Automated Imaging Association (AIA) at www.visiononline.org
- *GenICam Standard Features Naming Convention* available from the European Machine Vision Association (EMVA) at www.emva.org.
- *Programmable Logic Controller User Guide*

Chapter 2

About the iPORT PT1000-CL4 External Frame Grabber

This chapter describes the external frame grabber, including the product variants and key features.

The following topics are covered in this chapter:

The iPORT PT1000-CL4 External Frame Grabber

Pleora's iPORT™ PT1000-CL4 External Frame Grabbers allow system manufacturers and integrators to treat Camera Link® cameras as native GigE Vision® cameras. With these external frame grabbers, Camera Link cameras enjoy the long-distance reach of Gigabit Ethernet (GigE) and can be mixed with native GigE Vision cameras in networked environments.

The PT1000-CL4 External Frame Grabbers comply fully with the GigE Vision® and GenICam™ standards, enabling the products to interoperate seamlessly with other equipment in multi-vendor systems. System manufacturers and integrators can shorten time-to-market, lower design and system costs, and reduce development and deployment risk by reusing expensive or application-specific Camera Link cameras in GigE Vision installations, with minimal software development.

The PT1000-CL4 converts video data from Camera Link cameras to packets and transmits it over a GigE link with low, predictable latency. GigE supports cabling distances of up to 100 meters using standard CAT5e/6 cabling. With off-the-shelf Ethernet switches, distances can be unlimited.

The connection at the PC is a standard GigE plug, eliminating the need for a desktop PC with an available PCI slot. As a result, system designers can reduce system size, cost, and power consumption by using computing platforms with smaller form factors, such as laptops, embedded PCs, and single board computers.

A sophisticated on-board Programmable Logic Controller (PLC) allows users to precisely measure, synchronize, and control the operation of other elements.

The PT1000-CL is bundled with Pleora's feature-rich application toolkit, eBUS™ SDK, and compatible with Pleora's vDisplay™ External Frame Grabbers for HDMI output.

Features

- Transmits video from Camera Link Base mode cameras over GigE with low, consistent latency
- Built-in Programmable Logic Controller (PLC) for advanced real-time synchronization and triggering
- RS-232 and GPIO to control external accessories

For detailed information about the PLC, see the *iPORT Programmable Logic Controller User Guide*, available on the Pleora Support Center.

Product Formats: Board Set and Enclosed Unit

The iPORT PT1000-CL4 External Frame Grabber is available as either a compact board set designed for use in a variety of housings, or in a compact enclosure that can be used in a variety of applications as a stand-alone component within a simple point-to-point GigE network, or as part of a larger switched GigE network.

The following images show the OEM board set and the enclosed iPORT PT1000-CL4 External Frame Grabber.

iPORT PT1000-CL4 External Frame Grabber Board Set

iPORT PT1000-CL4 External Frame Grabber Enclosed Unit

Model Variants

The iPORT PT1000-CL4 External Frame Grabber is supplied in these variants and is equipped with these parts, as listed in the following table.

Table 1: Model Variants

iPORT PT1000-CL4 External Frame Grabber package variants*	
iPORT PT1000-CL4 OEM Board Set, 16 MB SDRAM or 128 MB SDRAM Variant	**Quantity**
iPORT PT1000-CL4 Board Set, 16 MB SDRAM or 128 MB SDRAM	1

iPORT PT1000-CL4 Enclosed, 16 MB SDRAM or 128 MB SDRAM Variant	**Quantity**
iPORT PT1000-CL4 enclosed unit, 16 MB SDRAM or 128 MB SDRAM	1

iPORT PT1000-CL4 Enclosed, 16 MB SDRAM 80 MHz Variant	**Quantity**
iPORT PT1000-CL4 enclosed unit, 16 MB SDRAM 80 MHz	1

iPORT PT1000-CL4 Evaluation Kit, 16 MB SDRAM or 128 MB SDRAM Variant	**Quantity**
iPORT PT1000-CL4 External Frame Grabber enclosed unit, 16 MB SDRAM or 128 MB SDRAM	1
Gigabit Ethernet network interface card (NIC)	1
Ethernet cable	1
Power supply	1
Pleora eBUS SDK, provided on CD or USB drive (includes GEVPlayer sample application)	1

*Before assembly, ensure that all components are included in the selected package.

Feature Set

Hardware	
Available as OEM board	Yes
Available as enclosed	Yes
SDRAM	16 MB or 128 MB
Inputs/Outputs	
LVTTL inputs*, LVTTL outputs (3.3V)	2 inputs, 2 outputs
LVDS inputs	1
Optically isolated inputs, outputs**	1 input and 1 output
Camera control outputs	4 x LVDS
Programmable Logic Control	
Timers	4
Rescaler (16-bit)	1
Delayers	1
General purpose counters	1
Input debouncing	Yes
Timestamp generator	Yes
Timestamp trigger	Yes
Software controlled IO	4
GPIO interrupts FIFO	Yes
Other	
Serial ports (UART)	1 x LVDS (CL) 1 x LVTTL (GPIO)
Supply voltage	Minimum. 4.5V Typical. 5V Maximum. 16V
Power consumption (measured at 10V)	Typical. 2.6W Maximum. 2.6W
Operating temperature	0° to 45°C (enclosed unit), 0° to 70°C (OEM)
Storage temperature	-40° to 85°C

Frame Grabber	
Ethernet bandwidth	1 gigabit per second
Unicast and multicast	Yes
Static configuration	Yes
DHCP and LLA	Yes
Number of data channels	1
Video input	Base Camera Link
Scan types	Progressive scan, area scan, and linescan
Color and data output formats	RGB, Bayer, YUV 422Packed, YUV 411Packed, YUV 444Packed
Monochrome	Yes
Grayscale data output	Yes
Pixel depth (bits)	8, 10, 12, 14, 16, 24
Pixel clock	Minimum. 20 MHz Maximum. 66 MHz For 80 MHz, version, maximum is 80 MHz
Taps per data channel	2
Image width (pixels) (must be a multiple of 4)	Minimum. 4 Default. 640 Maximum. 16,380
Image height (pixels)	Minimum. 1 Default. 480 Maximum. 16,383
Windowing	Yes
Data port mapping	Yes
Pixel inversion	Yes
Recording/playback	Yes

* Maximum input voltage: 5V. Minimum high-level input voltage (VIH): 2.1V, maximum low-level input voltage (VIL): 0.9V.
** Maximum input voltage: 5V. Minimum high-level input voltage (VIH): 2.0V, maximum low-level input voltage (VIL): 0.8V.

Selected GenICam Features

In addition to the mandatory GenICam features for any compliant GigE Vision device, the iPORT PT1000-CL4 External Frame Grabber provides a number of additional features. Selected GenICam features are listed in the following table. The first four features in the table are mandatory GenICam features, which are present in every GigE Vision compatible device.

Table 2: Selected GenICam Features

Feature	Description
Width	Specifies the width of the image (in pixels).
Height	Specifies the height of the image (in pixels).
OffsetX	Specifies the horizontal image offset (in pixels).
OffsetY	Specifies the vertical image offset (in pixels).
PixelFormat	Specifies the format of the pixel provided by the device. Available pixel formats are: • Monochrome pixel formats, 8 to 16 bits • Bayer pixel formats, 8 to 16 bits • RGB pixel formats, 8 bits • YUV411Packed • YUV422Packed • YUV444Packed
DeviceReset	Resets the external frame grabber to its power up state.
DeviceScanType	Specifies the sensor scan type, such as areascan or linescan.
SensorDigitizationTaps	Specifies the number of digitized samples that are simultaneously output by the camera A/D conversion stage.

Chapter 3

iPORT PT1000-CL4 External Frame Grabber Connections

This chapter describes the external frame grabber connections. It also includes pinouts for the GPIO, serial, and power connectors.

The following topics are covered in this chapter:

Connector Locations

The following figure and table describe the external frame grabber connectors.
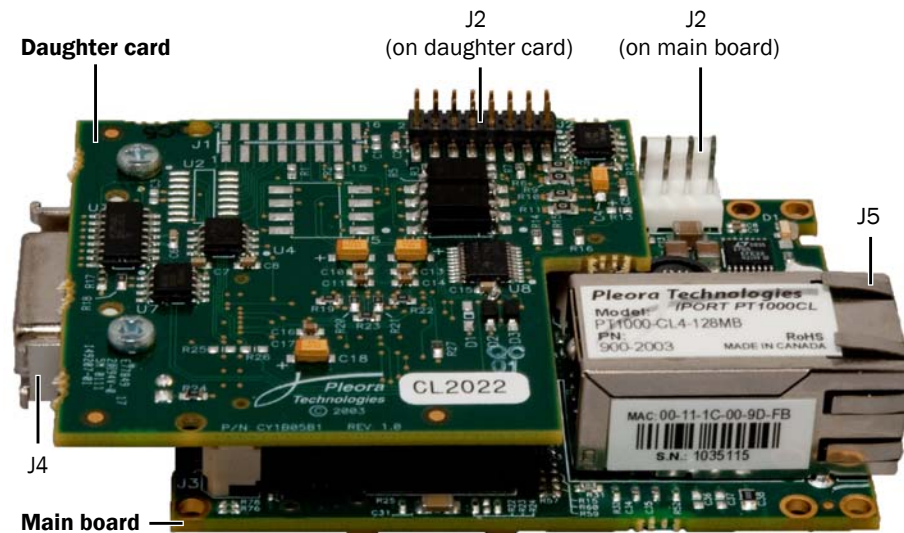
Table 3: External Frame Grabber Connections

ID	Location	Type	Description
J4	Daughter card	26-pin connector	Transmits images from a Camera Link camera to the external frame grabber through a Camera Link cable. You can connect one Camera Link Base mode camera to the external frame grabber.
J2	Main board	4-pin connector	Receives 4.5V to 16V of unfiltered DC input. The external frame grabber's power consumption is approximately 2.6W, temperature and input voltage dependent. See "Power Connector Pinouts" on page 13 for connector details and pinouts.
J2	Daughter card	16-pin male header	Provides GPIO signals to the external frame grabber. See "GPIO Connector Pinouts" on page 11 for connector details and pinouts.
J5	Main board	RJ-45 Ethernet connector	Interfaces the external frame grabber to Ethernet networks, as specified in IEEE 802.3. The Ethernet interface can operate at 10, 100, or 1000 Mbps, and supports Internet Protocol Version 4 (IPv4).

iPORT PT1000-CL4 External Frame Grabber User Guide

GPIO Connector Pinouts

The GPIO connector provides GPIO signals to the external frame grabber.

GPIO Connector Pinouts — OEM Board Set

The GPIO pinout descriptions for the OEM board set (J2 on the daughter card) are listed in the following table.

The mating connectors are in the Samtec MMS-108-02-xx-xx series. The mating flat connectors are in the Samtec TCSD series (TCSD-08-xxxxxxx).

Table 4: GPIO Connector Pinout Descriptions — OEM Board Set (J2 on the Daughter Card)

Pin	Name	Type
1	GND	Ground
2	VCC*	3.3 V at 250 mA max**
3	OPTO_OUT-	Optically isolated negative output
4	OPTO_OUT+	Optically isolated positive output
5	TTL_IN[0]	TTL input 0
6	TTL_OUT[0]	TTL output 0
7	TTL_OUT[1]	TTL output 1
8	TTL_IN[1]	TTL input 1
9	N/C	No connect (leave unconnected)
10	N/C	No connect (leave unconnected)
11	OPTO_IN-	Optically isolated negative input
12	OPTO_IN+	Optically isolated positive input
13	LVDS_IN-	Low-voltage differential signal negative input
14	LVDS_IN+	Low-voltage differential signal positive input
15	GND	Ground
16	VCC*	3.3 V at 250 mA max**

* Unprotected power from internal 3.3V power regulator. To route to a panel connector, a fuse is required.

** These VCC supplies are not recommended for analog circuitry. Analog circuitry should be driven from a separate 3.3V supply.

GPIO Connector Pinouts — Enclosed Unit

The GPIO and serial pinout descriptions for the enclosed unit are listed in the following table.
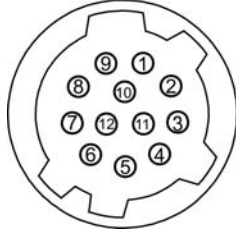
The mating connector is a Hirose 12-pin connector, part number HR10A-10P-12P(73).

Table 5: 12-Pin Connector — Pinout Descriptions

Pin	Signal Name	Type
1	OPTO_OUT-	Optically isolated negative output
2	OPTO_OUT+	Optically isolated positive output
3	TTL_IN[0]	TTL input 0
4	TTL_OUT[0]	TTL output 0
5	TTL_OUT[1]	TTL output 1
6	TTL_IN[1]	TTL input 1
7	OPTO_IN-	Optically isolated negative input
8	OPTO_IN+	Optically isolated positive input
9	LVDS_IN-	Low-voltage differential signal negative input
10	LVDS_IN+	Low-voltage differential signal positive input
11	GND	Ground
12	VCC*	3.3 V at 100 mA max

* Unprotected power from internal 3.3V power regulator. To route to a panel connector, a fuse is required.

Power Connector Pinouts

The power connector receives 4.5V to 16V of unfiltered DC input. The external frame grabber's power consumption is approximately 2.6W (measured at 10V), temperature and input voltage dependent.

The pinouts of the 4-pin header (J2 on the main board) are listed in the following table.

The 4-pin header mates with the Molex 4-pin shell (22-01-3047) and the Molex crimp pin (08-55-0102).

Table 6: Power Connector Pinout Descriptions — OEM Board Set (J2 on the main board)

Pin	Signal Name	Type	Description
1	GND	PWR	Ground
2	VIN	PWR	Power supply voltage in (4.5V to 16V regulated)
3	VIN	PWR	Power supply voltage in (4.5V to 16V regulated)
4	GND	PWR	Ground

Figure 1: PT1000-CL: Power Connector Locations on the OEM Board Set

Power Connector Pinouts — Enclosed Unit

The pinouts of the 6-pin power connector are listed in the following table.
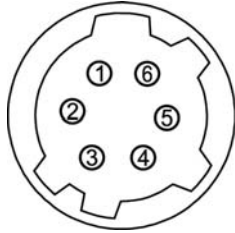
The mating connector is a Hirose 6-pin connector, part number HR10A-7P-6S(73).

Table 7: Power Connector Pinout Descriptions

Pin	Name
1	V_{in} 4.5V to 16V regulated
2	V_{in} 4.5V to 16V regulated
3	V_{in} 4.5V to 16V regulated
4	Ground
5	Ground
6	Ground

iPORT PT1000-CL4 External Frame Grabber User Guide

Chapter 4

Signal Handling

The PT1000-CL4 External Frame Grabber handles signals in much the same way as other iPORT external frame grabber models. There are a few minor differences, which are described in this chapter.

For an introduction to the PLC and for detailed information about how PLC signals are handled, see the *Programmable Logic Controller User Guide*, available on the Pleora Support Center at www.pleora.com.

The following topics are covered in this chapter:

PLC Control Blocks

The Programmable Logic Controller (PLC) in the iPORT PT1000-CL4 External Frame Grabber routes signals through a sophisticated PLC control block. The following figure shows the PLC control block signals for the iPORT PT1000-CL4 External Frame Grabber.

Figure 2: iPORT PT1000-CL4 External Frame Grabber PLC Control Block
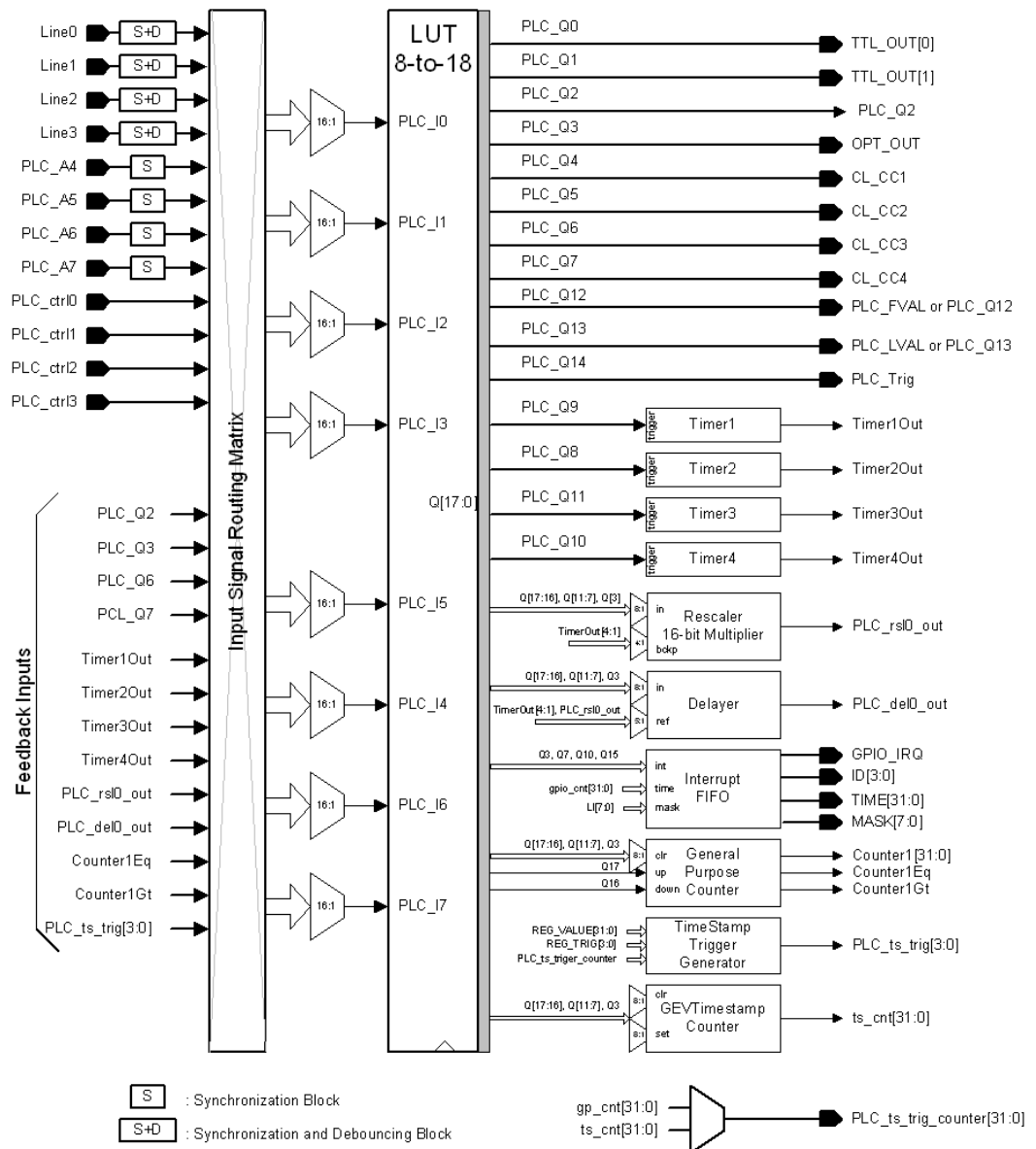
PLC Programming Signals

Table 8 and Table 9 list the PLC input and output programming signals that are specific to the iPORT PT1000-CL4 External Frame Grabber. The labels used for inputs to the PLC lookup table (LUT) depend on the input configured in the PLC lookup table dialog box.

Table 8: iPORT PT1000-CL4 External Frame Grabber PLC Input Signals

Input signal	PLC input signal	Description
TTL_IN[0]	Line0	LVTTL input 0
TTL_IN[1]	Line1	LVTTL input 1
LVDS_IN+/-	Line2	LVDS input
OPTO_IN+/-	Line3	Optically isolated input
CL_FVAL	PLC_A4	Camera Link Frame Valid signal. Refer to camera documentation to find out how specific cameras handle this signal.
CL_LVAL	PLC_A5	Camera Link Line Valid signal. Refer to camera documentation to find out how specific cameras handle this signal.
CL_DVAL	PLC_A6	Camera Link Data Valid signal. Refer to camera documentation to find out how specific cameras handle this signal.
CL_SPARE	PLC_A7	Camera Link spare signal. Refer to camera documentation to find out how specific cameras handle this signal

Table 9: iPORT PT1000-CL4 External Frame Grabber PLC Output Signals

Output signal	PLC output signal	Description
TTL_OUT[0]	PLC_Q0	LVTTL output 0
TTL_OUT[1]	PLC_Q1	LVTTL output 1
OPTO_OUT+/-	PLC_Q3	Optically isolated output
CL_CC1	PLC_Q4	Camera Link control 1*
CL_CC2	PLC_Q5	Camera Link control 2*
CL_CC3	PLC_Q6	Camera Link control 3*
CL_CC4	PLC_Q7	Camera Link control 4*

* For more information, see "Timing of Camera Link Control Signals" on page 19.

Camera Inputs

All Camera Link cameras have four standard output signals: Camera Link Frame Valid (FVAL), Camera Link Line Valid (LVAL), Camera Link Data Valid (DVAL), and Camera Link Spare (SPARE). FVAL and LVAL define when valid pixels are being transmitted. For more information, see the documentation accompanying the camera or the Camera Link specification.

Camera Controls

The Camera Link specification provides four camera control signals, which can be used in a variety of ways. For information on how your camera uses the signals, see the documentation accompanying the camera.

The labels of the control outputs to the camera in the PLC Control Block programming language are:

- Q4 for Camera Link CC1
- Q5 for Camera Link CC2
- Q6 for Camera Link CC3
- Q7 for Camera Link CC4

Camera Link Serial API

The eBUS SDK includes a dynamic-linked library (DLL) that you can use to establish a connection between a camera configuration application and a Camera Link camera. For information about using this DLL, see the *Establishing a Serial Bridge Application Note*, available on the Pleora Support Center.

Timing of Camera Link Control Signals

Table 10 shows the A.C. sub-clock delays of the Camera Link control signals. **RXXCLK** refers to **IN_CLK0** and **RXXOUT[27:0]** refers to all the inputs of the camera interface (**DATA[23:0]**, **CL_FVAL**, **CL_LVAL**, **CL_DVAL**, and **CL_SPR**). Figure 3 is a timing diagram for the sub-clock delays.

Table 10: A.C. Sub-Clock Delays on the Camera Interface

Parameter	Symbol	Min	Max	Units	Notes
RXXCLK high-level width	tCH	TBD		ns	50% duty cycle
RXXCLK low-level width	tCL	TBD		ns	50% duty cycle
RXXCLK frequency	fCP		66 or 80	MHz	
RXXCLK clock period	tCP	15.2 or 12.5 *		ns	
RXXOUT setup time	tDS	2		ns	By design
RXXOUT hold time	tDH	2		ns	By design
CL_CC pulse width	tCCP	30		ns	Asynchronous with respect to RXXCLK but can be sampled using OUT_CLK0

*The iPORT PT1000-CL4 External Frame Grabber RXXCLK clock period is 15.2ns. The RXXCLK clock period for the 80 MHz variant of the external frame grabber is 12.5ns.

Figure 3: Timing Diagram of A.C. Sub-Clock Delays on the Camera Interface
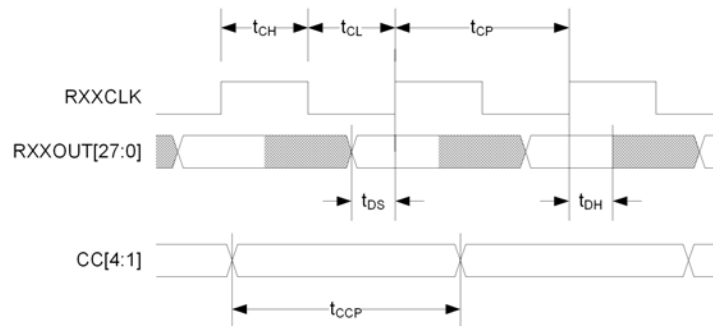
Serial Port (UART) Baud Rates and Timing

Both of the asynchronous serial ports/interfaces (SERTFG/ SERTC and IN[1]/OUT[1]) are UARTs. These interfaces only support 8-bit data transfer, 1 start bit, parity (even, odd, or none), and 1-2 stop bits. As shown in Table 11, a number of preset baud rates can be used, as well as a more flexible baud rate factor. See the *eBUS SDK C++ Help file* or the *eBUS SDK .NET Help file* for more details.

Table 11: UART Baud Rates

Baud Factor, BF	Baud Rate, BR [bps]	Notes
BF	1/(BF*480 ns)	Programmable
1 (min)	2,083,333	A baud factor of 0 is treated as a 1
18	115,200	Preset 6
36	57,600	Preset 5
54	38,400	Preset 4
72	28,800	Preset 3
109	19,200	Preset 2
145	14,400	Preset 1
217	9,600	Preset 0 (default)
255 (max)	8,170	

Table 12 shows the A.C. operating characteristics of the UART interfaces and Figure 4 is the corresponding timing diagram. The UART only sends one byte at a time. The time between bytes is not deterministic and depends on the computer/host's available resources. This can slow down the effective baud rate such that the time to send 1 KB of data is the same for 9,600 baud and 115,200 baud for example. If a serial interface must move large amounts of data and/or transfer time is an issue, it is recommended that the bulk interface be used.

Table 12: A.C. Operating Characteristics of the UART Interfaces

Parameter	Symbol	Min	Max	Units	Notes
Data Period	tUART	0.480*	122.4	μs	
Baud Rate	BR	8,170	2,083,333*	bps	1/TUART

* Fasted bit rate.

Figure 4: UART Timing Diagram

Chapter 5

Status LEDs

The status LEDs indicate the operating status of the external frame grabber's network connection and firmware. The following figure and table describe the status LEDs.
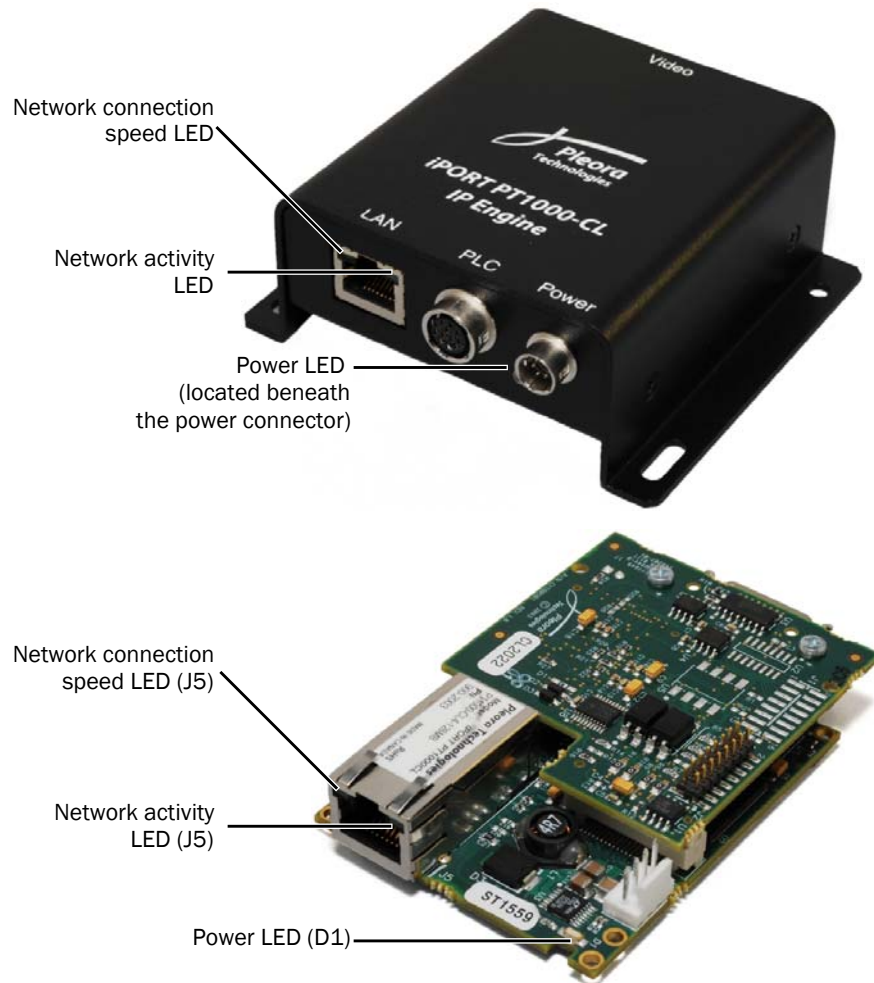
Table 13: Status LEDs

LED	ID	Description
Network activity	J5	**Green (solid).** Network connection. **Green (blinking).** Data receive/transmit. **Off.** No connection.
Network connection speed	J5	**Green.** 1 Gbps connection. **Off.** No connection, 10 Mbps connection, or 100 Mbps connection.
Power/FPGA	D1	**Off.** No power. **Green.** Power on. **Orange.** Main firmware load is corrupted, forcing the external frame grabber to use the backup firmware load.

iPORT PT1000-CL4 External Frame Grabber User Guide

Chapter 6

Installing the eBUS SDK

This chapter describes how to install the eBUS SDK, and also provides information about installing the required driver.

> Before you can configure and control your external frame grabber, you must install the eBUS SDK.

The following topics are covered in this chapter:

- "Installing the eBUS SDK" on page 24
- "Installing the Driver and Configuring the NIC" on page 24

Installing the eBUS SDK

You can install the Pleora eBUS SDK on your computer to configure and control your external frame grabber. Consult the *GEVPlayer Quick Start Guide* or *GEVPlayer User Guide* for information about setting up and configuring your camera for connection to the external frame grabber.

The Pleora Technologies eBUS SDK contains an extensive library of sample applications, with source code, to create working applications for device configuration and control, image and data acquisition, and image display and diagnostics.

It is possible for you to configure the external frame grabber and GigE Vision compliant video sources using other GenICam compliant software, however, this guide provides you with the instructions you need to use the Pleora GEVPlayer application.

To learn more about the features that are available in the eBUS SDK, along with details on creating applications for device configuration and control, image and data acquisition, and image display and diagnostics, see the *eBUS SDK Programmer's Guide* on the Pleora Support Center (www.pleora.com).

Installing the Driver and Configuring the NIC

Before you can configure the external frame grabber, use the Driver Installation Tool (included with the eBUS SDK) to install the correct driver. Then, set up your NIC. There are three choices of driver, depending on the NIC installed in your computer:

- Manufacturer Driver
- eBUS Universal Pro (for most NICs)
- eBUS Optimal (limited to particular Intel® NICs, available with eBUS SDK version 2.2 and earlier)

To install a Pleora driver

1. Click **Start** > **All Programs** > **Pleora Technologies Inc** > **eBUS SDK** > **Tools** > **Driver Installation Tool**.

2. From the list, identify the NIC(s) you want to use to connect to your GigE Vision device(s).

   If you have multiple NICs and you are having trouble distinguishing between them, see the tip at the end of this procedure.

3. In the **Action** column of the eBUS Driver Installation Tool, click the appropriate driver installation option.

4. Click **Install**.

5. Click **Close**.

   You may be required to restart your computer.

If multiple NICs appear and you are having difficulty distinguishing between them in the eBUS Driver Installation Tool, you can use the Windows Control Panel to see the MAC address of each NIC.

1. In the Windows Control Panel, click **Network and Internet**.

2. Click **Network and Sharing Center**.

3. Click the NIC and then click **Details**.

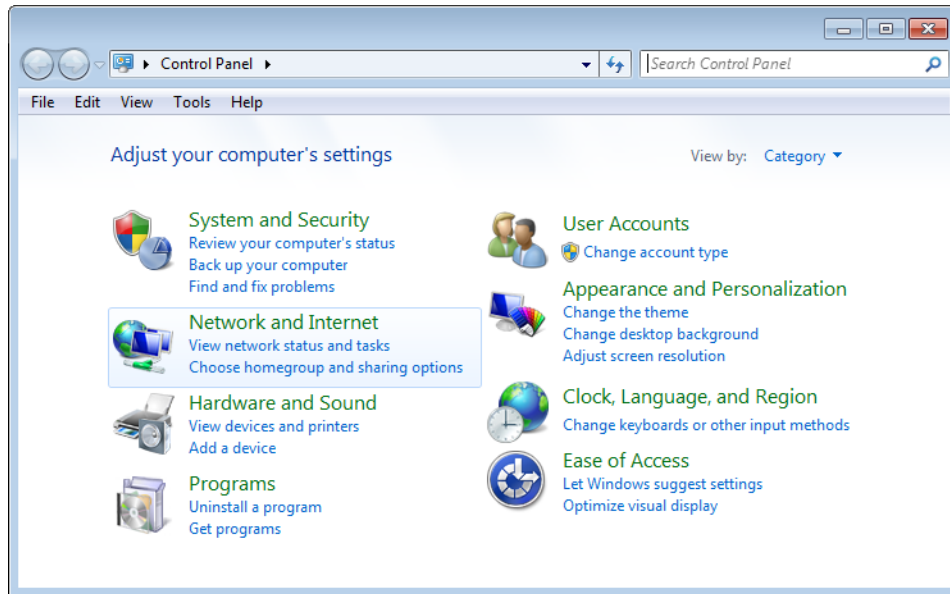   The MAC address appears beside **Physical Address**.

To see the versions of the installed drivers, click **Help** > **About**.

To configure an IP address for the NIC

1. In the Windows Control Panel, click **Network and Internet**.

The instructions in this procedure are based on the Windows 7 operating system. The steps may vary depending on your computer's operating system.


2. Click **Network and Sharing Center**.

3. In the left-hand panel, click **Change adapter settings**.

iPORT PT1000-CL4 External Frame Grabber User Guide
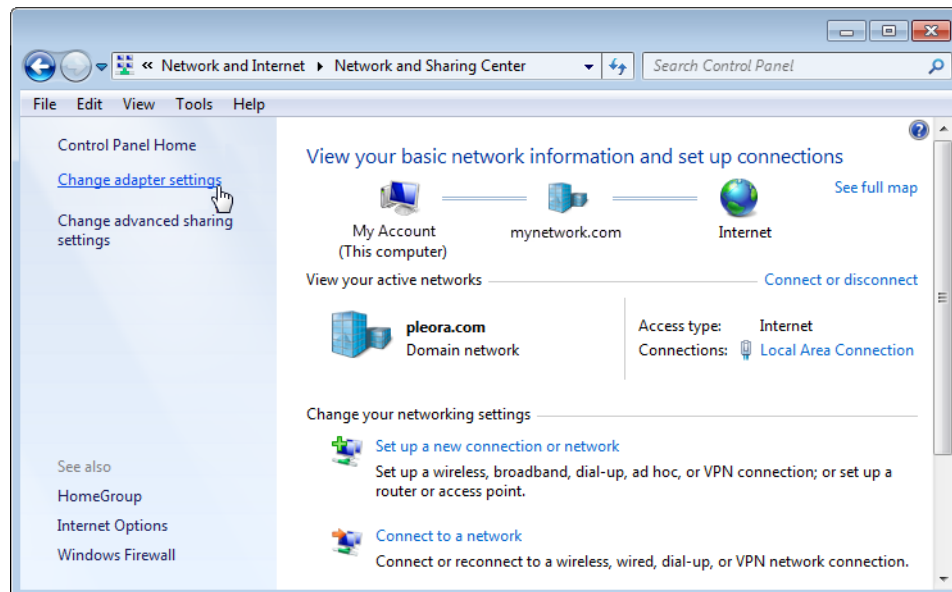
4. Right-click the NIC and then click **Properties**.

5. Click **Internet Protocol Version 4 (TCP/IPv4)** and then click **Properties**.
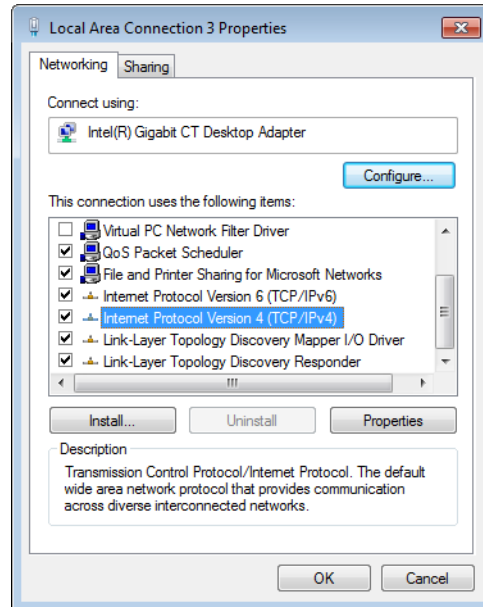
6. Select **Obtain an IP address automatically** or **Use the following IP address** to give the NIC an IP address.

7. Close the open dialog boxes to apply the changes and close the Control Panel.

iPORT PT1000-CL4 External Frame Grabber User Guide
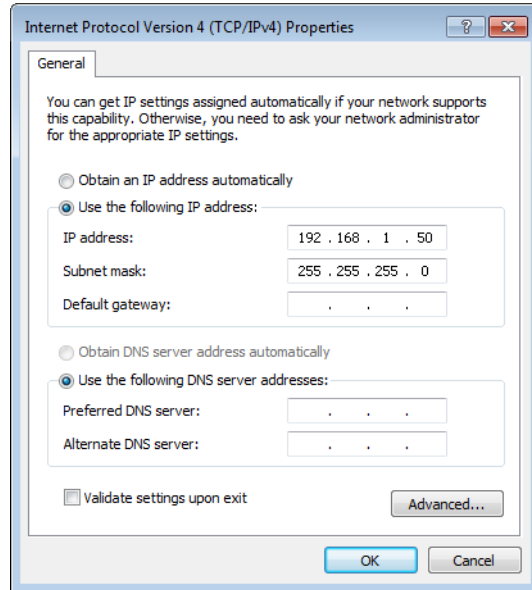
8. Configure the NIC for jumbo packets and set the NIC's Rx Descriptor to the maximum available value. Using jumbo packets allows you to increase system performance. However, you must ensure your NIC and GigE switch (if applicable) support jumbo packets.

To complete this task, right-click the NIC and click **Properties**. Then, click **Configure**. The exact configuration procedure, as well as the jumbo packet size limit, depends on the NIC.
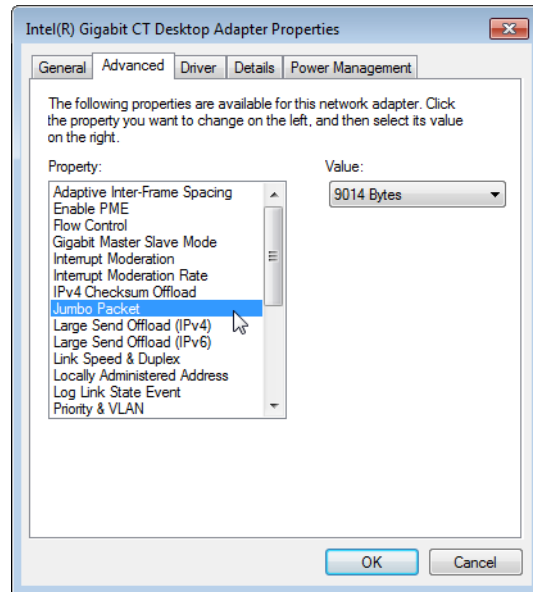
While not mandatory, you may wish to disable the network firewall and anti-virus software to improve system performance.

Chapter 7

Connecting to the External Frame Grabber and Configuring General Settings

After you have connected to the external frame grabber, you can provide it with a unique IP address on your network. When a connection is established, start GEVPlayer and connect to the external frame grabber. Then you can configure its image settings to ensure images are received and displayed properly. You can also configure the buffer options to reduce the likelihood of lost packets.

> GEVPlayer is documented in more detail in the *GEVPlayer Quick Start Guide* and the *GEVPlayer User Guide*. The *iPORT PT1000-CL4 External Frame Grabber User Guide* provides you with the GEVPlayer instructions and overviews required to set up and configure the external frame grabber.

The following topics are covered in this chapter:

- "Connecting the Ethernet Cables and Confirming Image Streaming" on page 32
- "Configuring the Buffers" on page 33
- "Providing the External Frame Grabber with an IP Address" on page 34
- "Configuring the External Frame Grabber's Image Settings" on page 35
- "Configuring a Camera Link Camera" on page 38
- "Configuring the Sensor Scan Type and Device Taps" on page 39
- "Implementing the eBUS SDK" on page 40

Connecting the Ethernet Cables and Confirming Image Streaming

The external frame grabber can communicate with your computer using either a direct connection or by connecting to a 10 GigE switch. This section explains how to connect the external frame grabber to a 10 GigE switch to confirm that images are streaming.

To connect the Ethernet cables and apply power

1. Connect the external frame grabber to the RJ-45 Ethernet connector on your computer's NIC.
2. Apply power.

To start GEVPlayer and connect to a device

1. Start GEVPlayer from the Windows **Start** menu.
2. Click **Select/Connect**.

   If the device does not appear in the list, click the **Show unreachable GigE Vision Devices** check box to show all devices.
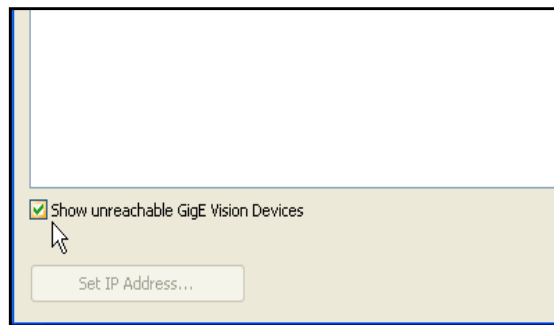
3. In the **GigE Vision Device Selection** dialog box, click the external frame grabber.

If the IP address is not valid, a warning (🚫) appears in the **Device Selection** dialog box. Provide the device with an IP address, as outlined in *"Providing the External Frame Grabber with an IP Address"* on page 34.

4. Click **OK**.

   GEVPlayer is now connected to the device.

To confirm image streaming

1. Click **Play** to stream live images or the test pattern.
2. After you confirm that images are streaming, click **Stop**.

If images do not stream, see the tips provided in *"System Troubleshooting"* on page 53.

Configuring the Buffers

You can increase the buffer count in GEVPlayer to reduce the impact and likelihood of lost and out-of-order packets, and to make streaming more robust. A high number of buffers are needed in high frame rate applications, while a small number of buffers are needed for lower frame rates. Applications using a high number of buffers might experience greater latency.
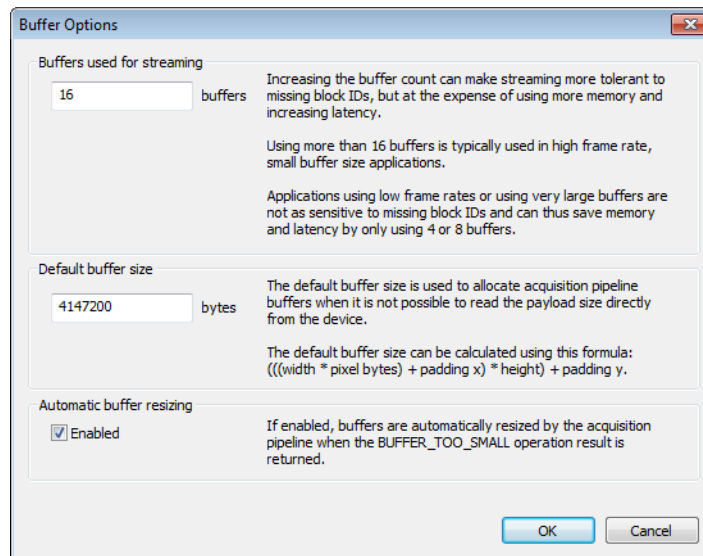
To configure the buffers

1. Start GEVPlayer and connect to the external frame grabber.

   For more information, see "To start GEVPlayer and connect to a device" on page 32.

2. Click **Tools** > **Buffer Options**.

3. Click the buffer option that suits your requirements.

4. Click **OK**.

Default size for streaming is 16 buffers.

Providing the External Frame Grabber with an IP Address

The external frame grabber requires an IP address to communicate on a video network. This address must be on the same subnet as the computer that is performing the configuration and receiving the image stream.

To provide the external frame grabber with an IP address

1. Start GEVPlayer.
2. Click **Select/Connect**.
3. Click the external frame grabber.
4. Click **Set IP Address**.
5. Provide the external frame grabber with a valid IP address and subnet mask. You can optionally provide a default gateway.

> If you are using a unicast network configuration, the management entity/data receiver and the external frame grabber must be on the same subnet. The unicast network configuration is outlined in "Unicast Network Configuration" on page 42.

6. Click **OK** to close the **Set IP Address** dialog box.
7. Click **OK** to close the **GigE Vision Device Selection** dialog box and connect to the device.

Configuring an Automatic/Persistent IP Address

The Device Control dialog box allows you to configure a persistent IP address for the external frame grabber. Alternatively, the external frame grabber can be configured to automatically obtain an IP address using Dynamic Host Configuration Protocol (DHCP) or Link Local Addressing (LLA). The external frame grabber uses its persistent IP address first, but if this option is set to **False**, it can be configured to attempt to obtain an address from a DHCP server. If this fails, it will use LLA to find an available IP address. LLA cannot be disabled and is always set to **True**.

To configure a persistent IP address

1. Start GEVPlayer and connect to the external frame grabber.

   For more information, see "To start GEVPlayer and connect to a device" on page 32.
2. Under **Parameters and Controls**, click **Device control**.
3. Under **TransportLayerControl**, set the **GevCurrentIPConfigurationPersistentIP** feature to **True**.
4. Set the **GevPersistentIPAddress** feature to a valid IP address in the **GevPersistentIPAddress** field.
5. Set the **GevPersistentSubnetMask** feature to a valid subnet mask address.
6. Optionally, enter a valid default gateway in the **GevPersistentDefaultGateway** field.
7. Close the **Device Control** dialog box.
8. Power cycle the external frame grabber.

To automatically configure an IP address

1. Start GEVPlayer and connect to the external frame grabber.

   For more information, see "To start GEVPlayer and connect to a device" on page 32.

2. Under **Parameters and Controls**, click **Device control**.

3. Under **TransportLayerControl**, set the **GevCurrentIPConfigurationPersistentIP** feature to **False**.

4. Set the **GevCurrentIPConfigurationLLA** and/or **GevCurrentIPConfigurationDHCP** values to **True**, depending on the type of automatic addressing you require.

5. Close the **Device Control** dialog box.

6. Power cycle the external frame grabber.

Configuring the External Frame Grabber's Image Settings

You can configure the external frame grabber's image settings, which provide the external frame grabber with information about the image coming from the camera. These settings allow the images to appear correctly.

The image settings are located under **ImageFormatControl** in the **Device Control** dialog box.

> For information about configuring the external frame grabber to send serial commands to a Camera Link camera that uses a CLProtocol DLL, see the *Establishing a Serial Bridge eBUS SDK Application Note* available on the Pleora Technologies Support Center.

To turn the test pattern on or off

1. Start GEVPlayer and connect to the external frame grabber.

   For more information, see "To start GEVPlayer and connect to a device" on page 32.

1. Under **Parameters and Controls**, click **Device control**.

2. Under **ImageFormatControl**, click a test pattern option in the **TestImageSelector** list.

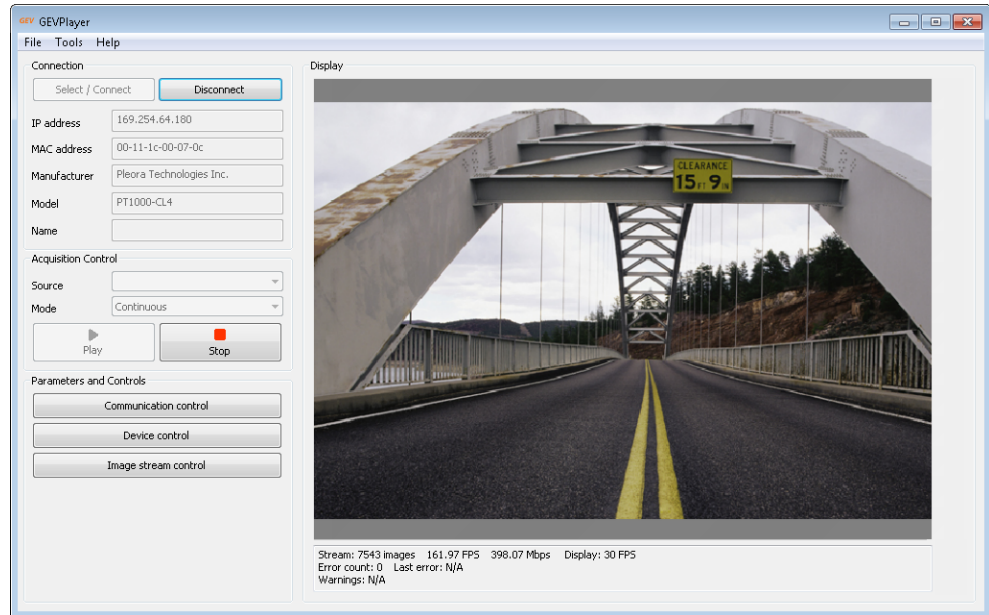3. Close the **Device Control** dialog box.

To change the pixel format

1. Start GEVPlayer and connect to the external frame grabber.

   For more information, see "To start GEVPlayer and connect to a device" on page 32.

2. If images are streaming, click the **Stop** button.

3. Under **Parameters and Controls**, click **Device control**.

4. Under **ImageFormatControl**, set the **PixelFormat** feature to a color format, such as **YUV444Packed, YUV411Packed**, **YUV422Packed, Bayer**, or **RGB** (by default the **PixelFormat** is set to **Mono8**).
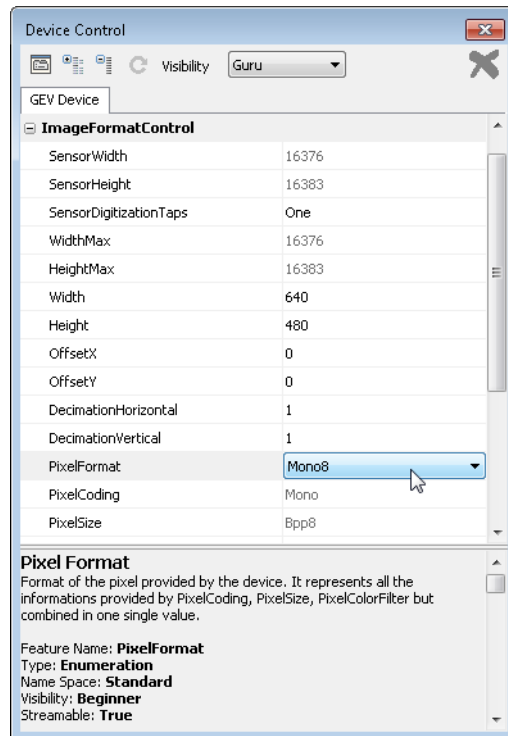
5. Close the **Device Control** dialog box.

6. Click **Play** to see the changes.

To configure the image width and height

1. Start GEVPlayer and connect to the external frame grabber.

For more information, see "To start GEVPlayer and connect to a device" on page 32.

2. If images are streaming, click the **Stop** button.

3. Under **Parameters and Controls**, click **Device control**.

4. Under **ImageFormatControl**, change the **Width** and **Height** to suit your camera.

5. Close the **Device Control** dialog box.

Configuring a Camera Link Camera

To configure a Camera Link camera, you can use one of the methods outlined in the following table.

Table 14: Connection Methods for Configuring Camera Link Cameras

Connection Method	Use this Method When...
Direct serial connection	You want to manually type commands that are directly sent to the camera. This method uses the **Serial Communications** dialog box in GEVPlayer.
Serial Communication Bridge, Camera Link serial DLL connection	You are using a third-party camera configuration application that requires that you use a Camera Link serial DLL to send serial commands to the camera.
Serial Communication Bridge, CLProtocol DLL and GenICam CLProtocol connection	The camera manufacturer has provided a CLProtocol DLL that allows you to configure and monitor settings within the camera using GenICam.

For more information about the Serial Communication Bridge methods, see the *Establishing a Serial Bridge Application Note* available on the Pleora Support Center.

Configuring the Sensor Scan Type and Device Taps

The PT1000-CL4 external frame grabber supports a single Camera Link Base camera, which streams image data to the external frame grabber using a standard Camera Link cable.

To ensure images are received properly, you must configure the sensor scan type (either areascan or linescan) and select the number of taps for your camera. All of this information is provided by the camera manufacturer.

To configure the sensor scan type and device taps

1. Start GEVPlayer and connect to the external frame grabber.

   For more information, see

2. If images are streaming, click the **Stop** button.

3. Under **Parameters and Controls**, click **Device control**.

4. Click **Guru** in the **Visibility** list.

5. Under **DeviceControl**, select a sensor scan type (areascan or linescan) in the **DeviceScanType** list.
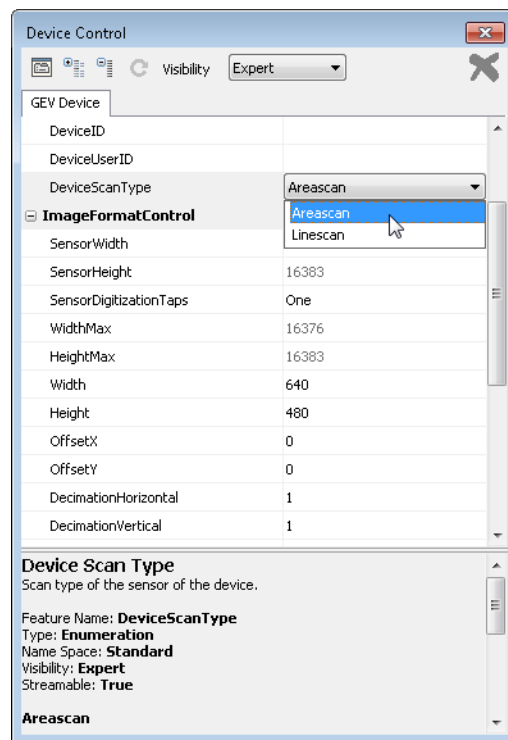
6. Under **ImageFormatControl**, select the number of taps in the **SensorDigitizationTaps** list.

7. Close the **Device Control** dialog box.

Implementing the eBUS SDK

You can create your own image acquisition software for the external frame grabber. Consult the *eBUS SDK Programmer's Guide*, the *eBUS SDK C++ API Help file,* and the *eBUS SDK .NET API Help file* for information about creating custom image acquisition software.

Chapter 8

Network Configurations

After you have connected to the external frame grabber and provided it with a unique IP address on your network, you can configure the external frame grabber for either unicast or multicast.

The following topics are covered in this chapter:

- "Unicast Network Configuration" on page 42
- "Multicast Network Configuration" on page 45

Unicast Network Configuration

In a unicast configuration, an external frame grabber is connected to a GigE switch that sends a stream of images over Ethernet to the computer. Alternatively, the external frame grabber can be connected directly to the computer.

The computer is configured as both a data receiver and controller, and serves as a management entity for the external frame grabber.

Figure 5: Unicast Network Configuration

Computer management entity/data receiver

Ethernet

GigE switch

Ethernet

External frame grabber

Camera Link Base Camera
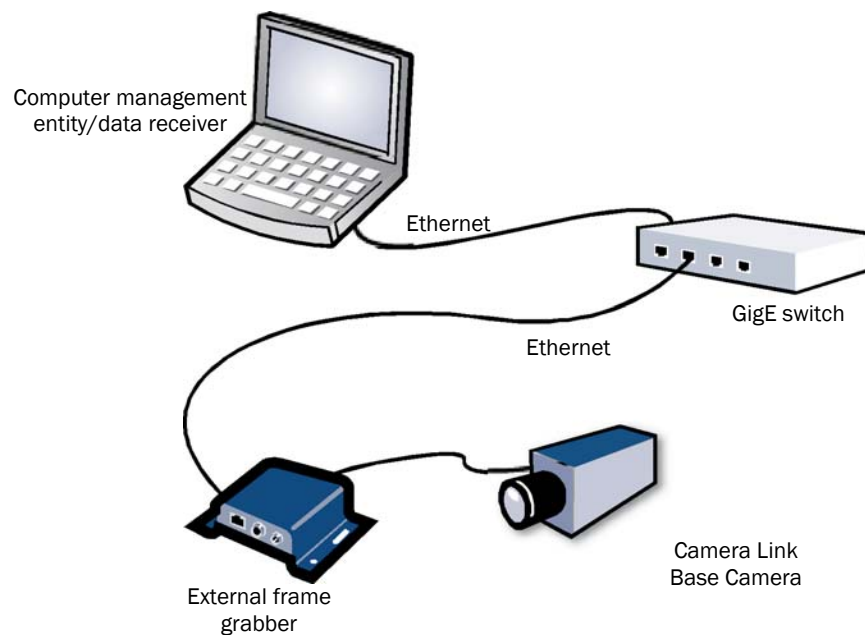
Required Items — Unicast Network Configuration

You require the following components to set up a unicast network configuration:

- iPORT PT1000-CL4 External Frame Grabber and corresponding power supply
- CAT5e or CAT6 Ethernet cable (quantity: 1)
- GigE switch and an additional CAT5e or CAT6 Ethernet cable (optional)
- Desktop computer or laptop with eBUS SDK, version 2.0.0 (or later) installed
- Camera and cables

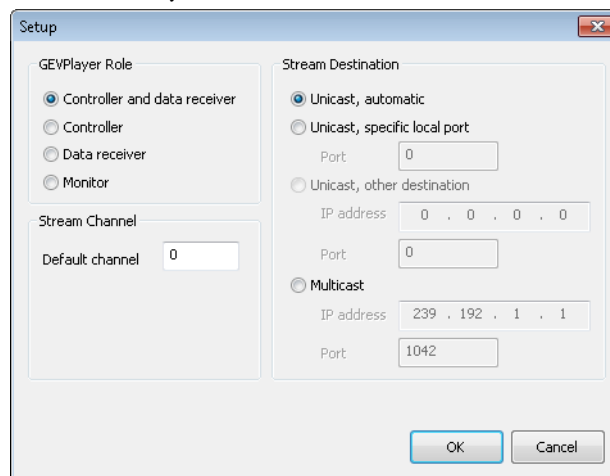## External Frame Grabber Configuration — Unicast Network Configuration

After you have connected and applied power to the hardware components, use GEVPlayer to configure the external frame grabber.

To configure the external frame grabber for a unicast network configuration
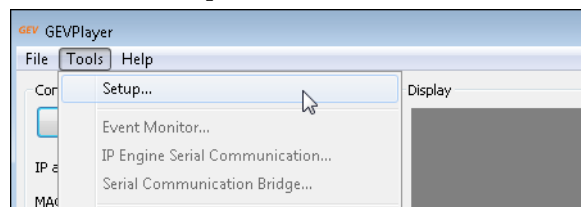
1. Start **GEVPlayer**.
2. Click **Tools > Setup**.

3. Under **GEVPlayer Role**, click **Controller and data receiver**.

4. Under **Stream Destination**, click **Unicast, automatic**.
5. Click **OK**.
6. Connect to the external frame grabber.

   For more information, see "To start GEVPlayer and connect to a device" on page 32.

7. Click **Play** to view a live image stream.

iPORT PT1000-CL4 External Frame Grabber User Guide
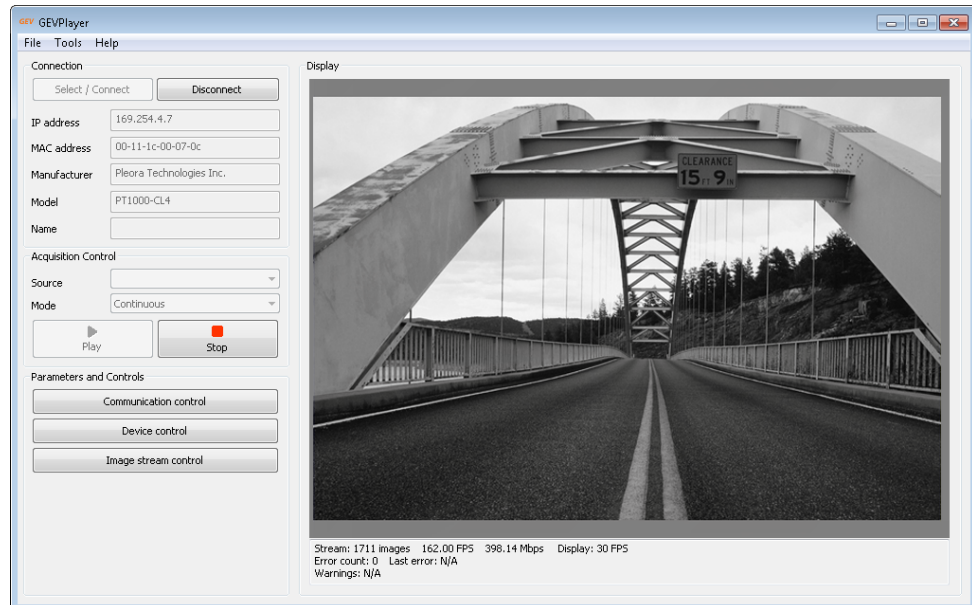
Multicast Network Configuration

In a multicast network configuration, the iPORT PT1000-CL4 External Frame Grabber is connected to a GigE switch, and sends a stream of images over Ethernet simultaneously to both a computer and to a vDisplay HDI-Pro External Frame Grabber. Then, the vDisplay HDI-Pro External Frame Grabber converts it to an image stream for display on a monitor.

Figure 6: Multicast Network Configuration
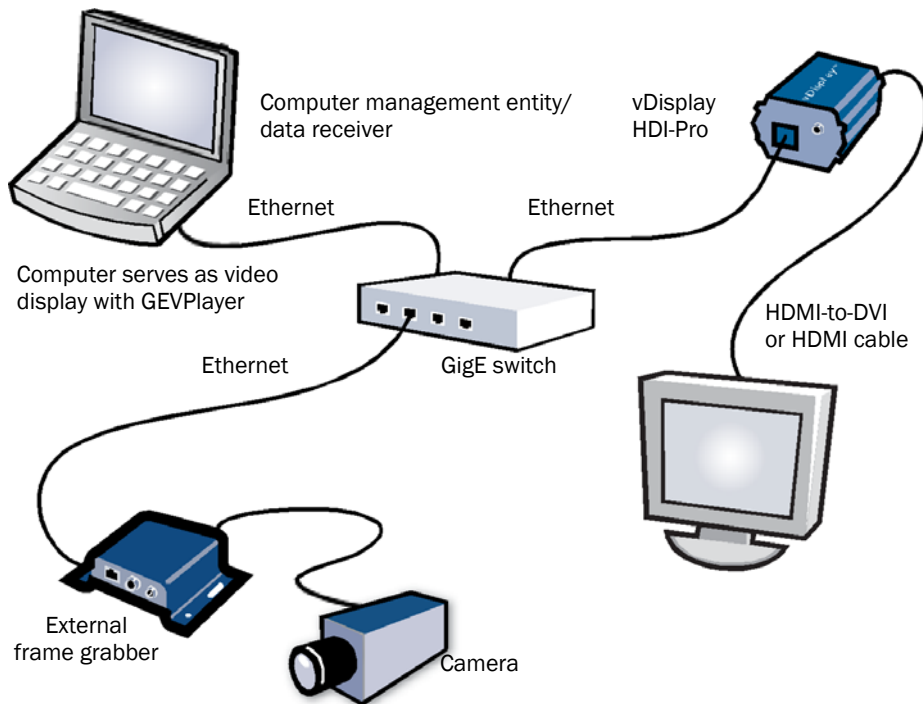
Required Items — Multicast Network Configuration

You require the following components to set up a multicast network configuration:

- iPORT PT1000-CL4 External Frame Grabber and corresponding power supply
- vDisplay HDI-Pro External Frame Grabber and corresponding power supply
- Compatible display monitor
- Cable to connect the vDisplay HDI-Pro External Frame Grabber to the display monitor
- CAT5e or CAT6 Ethernet cables (quantity: 3)
- GigE switch and an additional CAT5e or CAT6 Ethernet cable (optional)
- Desktop computer or laptop with eBUS SDK, version 2.0.0 (or later) installed
- Camera and cables

Connecting the Hardware and Power

The following procedure explains how to connect the power, network, and data cables to the vDisplay HDI-Pro External Frame Grabber and PT1000-CL4 External Frame Grabber.

To connect the network cables and apply power

1. Connect one end of a CAT5e/CAT6 cable to the Ethernet connector on your computer's NIC. Attach the other end to an available port on the 10 GigE switch.
2. Attach one end of the video cable to the display monitor. Attach the other end to the HDI connector on the vDisplay HDI-Pro External Frame Grabber.
3. Connect one end of a CAT5e/CAT6 cable to the vDisplay HDI-Pro External Frame Grabber Ethernet connector. Attach the other end to an available port on the GigE switch.
4. Connect one end of a CAT5e/CAT6 cable to the iPORT PT1000-CL4 External Frame Grabber Ethernet connector. Attach the other end to an available port on the GigE switch.
5. Apply power to the devices.

The message **No Video** appears on the display monitor.
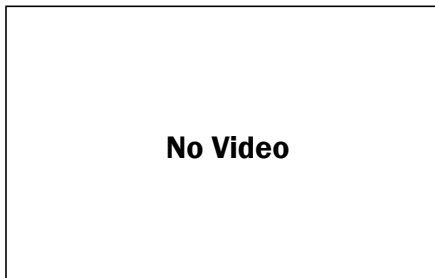
No Video

## Configuring the Devices for a Multicast Network Configuration

After you have connected and applied power to the hardware components, use GEVPlayer to configure the vDisplay HDI-Pro External Frame Grabber and iPORT PT1000-CL4 External Frame Grabber for multicast configuration. You may want to launch two instances of GEVPlayer to perform both configurations. Begin by configuring the vDisplay HDI-Pro External Frame Grabber. Then, configure the external frame grabber to transmit images to a multicast IP address and port.

> The vDisplay HDI-Pro External Frame Grabber is documented in the *vDisplay HDI-Pro External Frame Grabber User Guide*. The *iPORT PT1000-CL4 External Frame Grabber User Guide* provides you with the vDisplay HDI-Pro External Frame Grabber instructions and overviews required to set up and configure the vDisplay HDI-Pro External Frame Grabber for a multicast configuration.

To configure the devices for a multicast network configuration

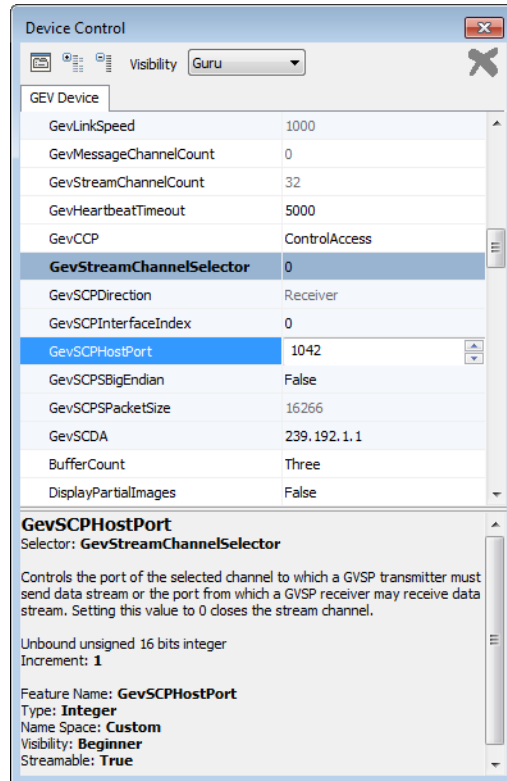1. Start **GEVPlayer**.
2. Click **Tools > Setup**.
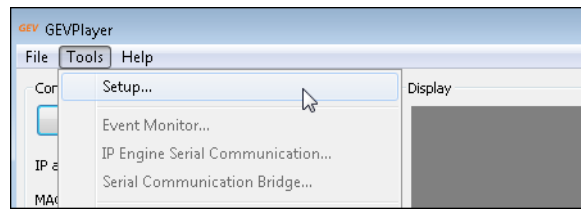
3. Under **GEVPlayer Role**, click **Controller**.

   You do not need to specify the **Stream Destination**, as the stream destination is not applicable to a video receiver.
4. Click **OK**.
5. Connect to the vDisplay HDI-Pro External Frame Grabber.

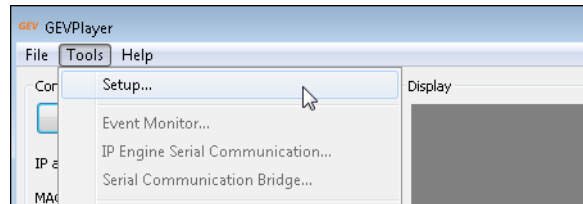   For more information, see "To start GEVPlayer and connect to a device" on page 32.

6. Click **Device control**.

7. Click **Guru** in the **Visibility** list.

8. In the **TransportLayerControl** category, set **GevSCPHostPort** to a streaming channel port (for example, 1042).

**9.** Set **GevSCDA** to a multicast address (for example, 239.192.1.1).

10. Close the **Device Control** dialog box.

11. Now, configure the iPORT PT1000-CL4 External Frame Grabber, as outlined in "To configure the iPORT PT1000-CL4 External Frame Grabber for a multicast network configuration" on page 49.

To configure the iPORT PT1000-CL4 External Frame Grabber for a multicast network configuration

1. Start an additional instance of GEVPlayer.

2. Click **Tools > Setup**.

3. Under **GEVPlayer Role**, click **Controller and data receiver**.
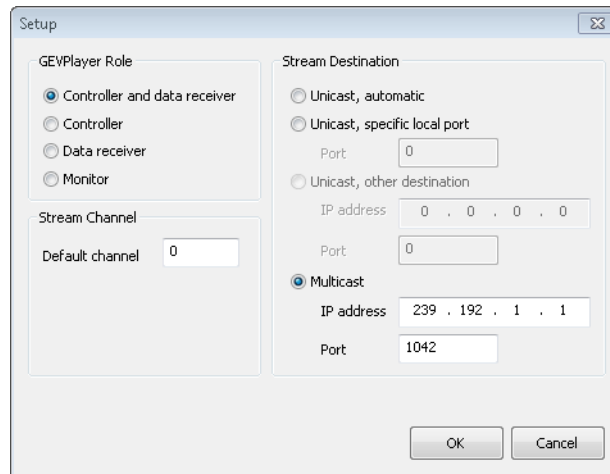
4. Under **Stream Destination**, click **Multicast** and enter the **IP address** and **Port** number.

   The address and port must be identical to that configured for the vDisplay HDI-Pro External Frame Grabber in step 8 and 9 of "To configure the devices for a multicast network configuration" on page 47.

5. Click **OK**.

6. Connect to the iPORT PT1000-CL4 External Frame Grabber.

   For more information, see "To start GEVPlayer and connect to a device" on page 32.

7. Under **Parameters and Controls**, click **Device control**.

8. Click **Guru** in the **Visibility** list.

9. Under **TransportLayerControl**, ensure that the port in the **GevSCPHostPort** field and the multicast IP address in the **GevSCDA** field are correct. They are configured automatically to the values set in step 4 of this procedure.
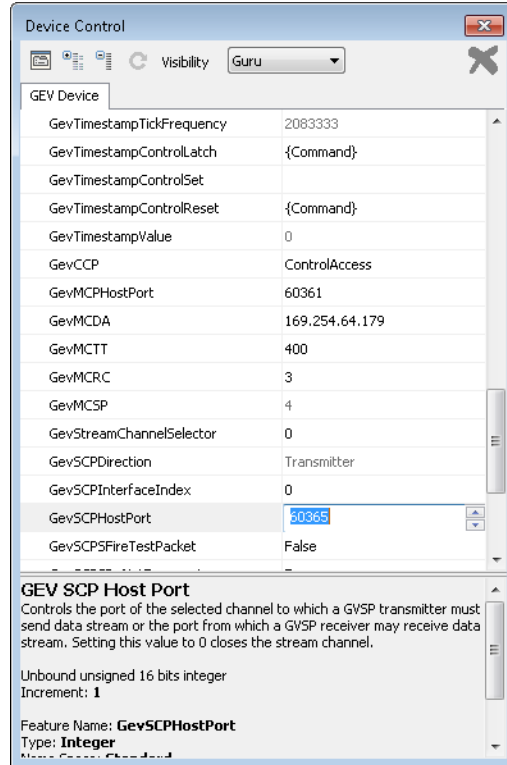

10. Close the **Device Control** dialog box.

11. Click **Play** to view the source image stream both on the computer and the display monitor.

The multicast image is shown on the computer and the display monitor receiver, as shown below.
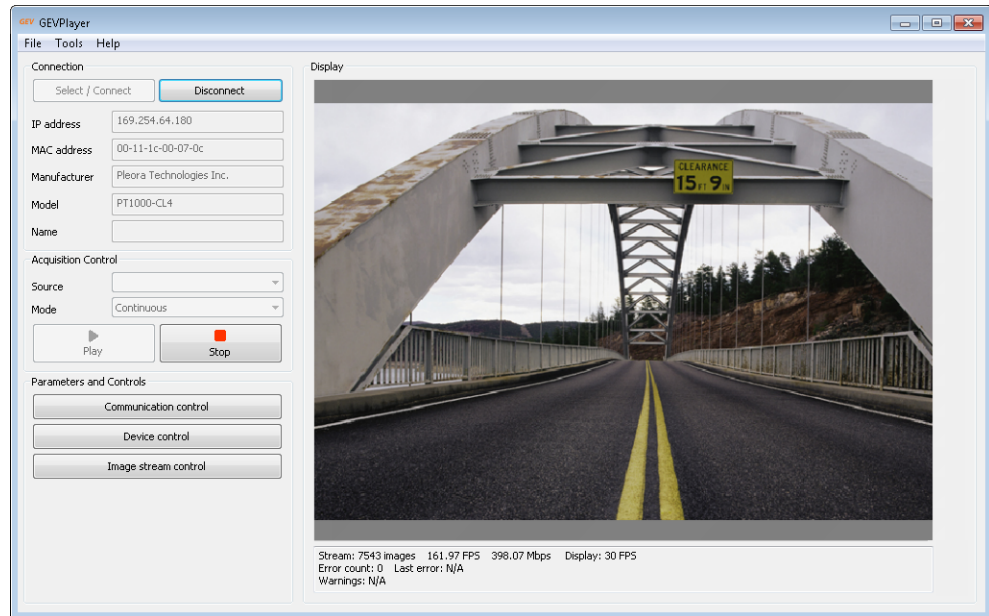
An overview of the steps for the simple multicasting of the iPORT PT1000-CL4 External Frame Grabber with the vDisplay HDI-Pro External Frame Grabber is shown in the following figure.
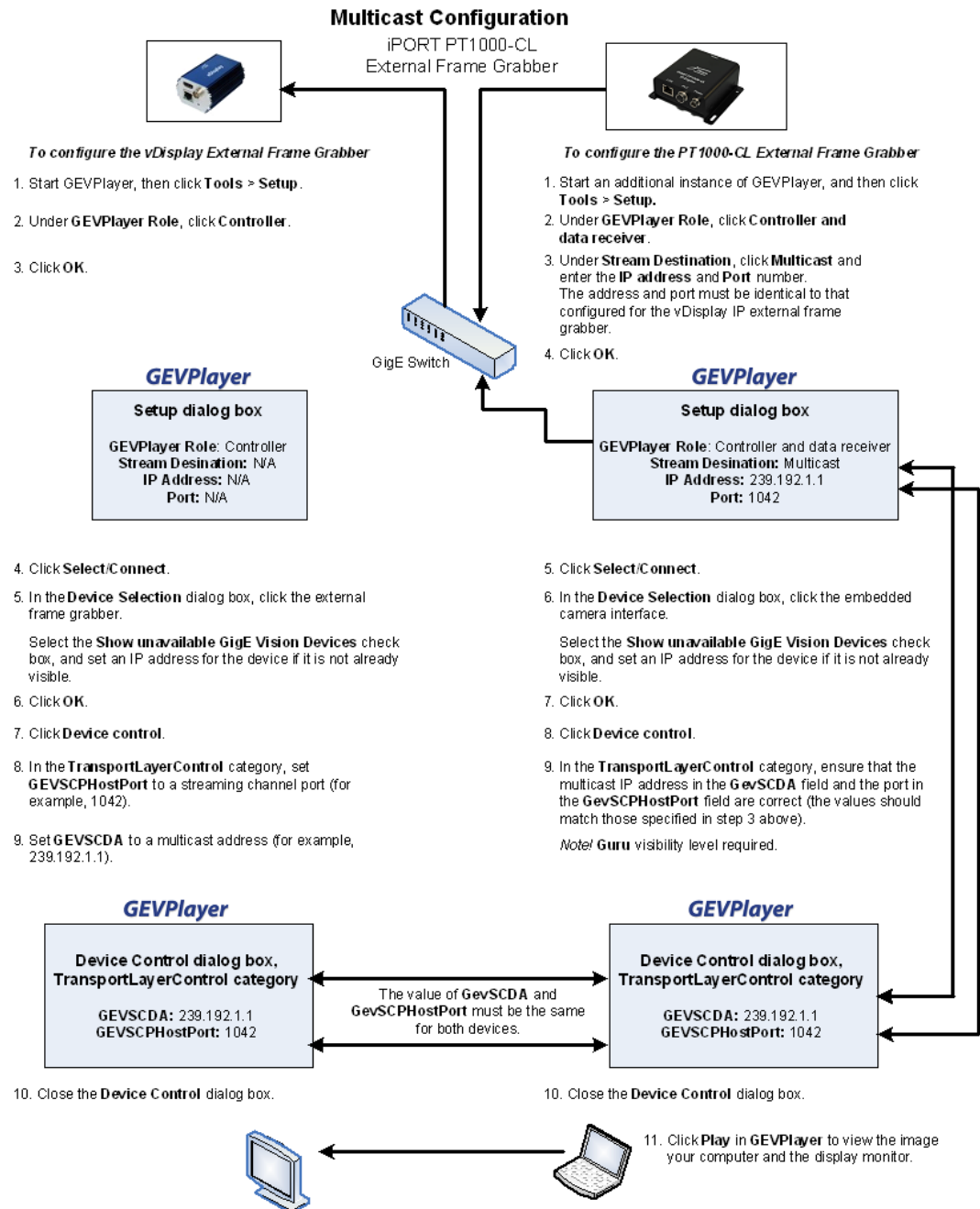
Chapter 9

System Troubleshooting

This chapter provides you with troubleshooting tips and recommended solutions for issues that can occur during configuration, setup, and operation of the PT1000-CL4 External Frame Grabber.

> Not all scenarios and solutions are listed here. You can refer to the Pleora Technologies Support Center at www.pleora.com for additional support and assistance.

The Pleora Technologies Support Center can help you to learn more about integrating Pleora Technologies products. Use keywords to search the Pleora Technologies knowledge database for solutions and suggestions to optimize and troubleshoot Pleora Technologies products. The knowledge database includes a description of the issue and the suggested solution for your search results.

Details for creating a customer account are available on the Pleora Technologies Support Center.

> Refer to the product release notes that are available on the Pleora Technologies Support Center for known issues and other product features.

Troubleshooting Tips

The scenarios and known issues listed in the following table are those that you might encounter during the setup and operation of your external frame grabber. Not all possible scenarios and errors are presented. The symptoms, possible causes, and resolutions depend upon your particular network, setup, and operation.

> If you perform the resolution for your issue and the issue is not corrected, we recommend you review the other resolutions listed in this table. Some symptoms may be interrelated.

Table 15: Troubleshooting Tips

Symptom	Possible cause	Resolution
SDK cannot detect or connect to the external frame grabber	Power not supplied to the external frame grabber	Both the detection and connection to the external frame grabber will fail if power is not supplied to the device. Verify that the Power/FPGA LED (D1 on the main board) is green (power on). For information about the LEDs, see "Status LEDs" on page 21. Verify the power connection and ensure 4.5V is present at the connector (maximum: 16V). Re-try the connection to the external frame grabber with GEVPlayer.
	The external frame grabber is not connected to the network	Verify that the network activity LED and network connection speed LED is are active (J5 on the main board). If these LEDs are illuminated, check the LEDs on your network switch to ensure the switch is functioning properly. If the problem continues, connect the external frame grabber directly to the computer to verify its operation. For information about the LEDs, see "Status LEDs" on page 21.
	The external frame grabber and computer are not on the same subnet	Images might not appear in GEVPlayer if the external frame grabber and the computer running GEVPlayer are not on the same subnet. Ensure that these devices are on the same subnet. In addition, ensure that these devices are connected using valid gateway and subnet mask information. You can view the external frame grabber IP address information in the **Available GigE Vision Devices** list in GEVPlayer. A red icon appears beside the device if there is an invalid IP configuration.

Table 15: Troubleshooting Tips (Continued)

Symptom	Possible cause	Resolution
SDK is able to connect, but no images appear in GEVPlayer. In a multicast configuration, images appear on a display monitor connected to a vDisplay External Frame Grabber but do not appear in GEVPlayer.	In a multicast configuration, the external frame grabber may not be configured correctly	Images might not appear on the display if you have not configured the external frame grabber for a multicast network configuration. The external frame grabber and all multicast receivers (for example, a vDisplay HDI-Pro External Frame Grabber) must have identical values for both the **GevSCDA** and **GevSCPHostPort** features in the **TransportLayerControl** section. For more information, see "Configuring the Devices for a Multicast Network Configuration" on page 47.
	In a multicast configuration, your computer's firewall may be blocking GEVPlayer	Ensure that GEVPlayer is allowed to communicate through the firewall.
	Anti-virus software or firewalls blocking transmission	Images might not appear in GEVPlayer because of anti-virus software or firewalls on your network. Disable all virus scanning software and firewalls, and re-attempt a connection to the external frame grabber with GEVPlayer.
Dropped packets: GEVPlayer, NetCommand, or applications created using the eBUS SDK	Insufficient computer performance	The computer being used to receive images from the external frame grabber may not perform well enough to handle the data rate of the image stream. The eBUS Universal Pro driver reduces the amount of computer resources required to receive images, and is recommended for applications that require high throughput. Should the application continue to drop packets even after the installation of the eBUS Universal Pro driver, a computer with better performance may be required. For more information about installing the driver, see "Installing the Driver and Configuring the NIC" on page 24.
	Insufficient NIC performance	The NIC being used to receive images from the external frame grabber may not perform well enough to handle the data rate of the image stream. For example, the bus connecting the NIC to the CPU may not be fast enough, or certain default settings on the NIC may not be appropriate for reception of a high-throughput image stream. Examples of NIC settings that may need to be reconfigured include the number of Rx Descriptors and the maximum size of Ethernet packets (jumbo packets). Additionally, some NICs are known to not work well in high-throughput applications. For information about maximizing the performance of your system, see the *Configuring Your Computer and Network Adapters for Best Performance Application Note*, available on the Pleora Support Center.
Black bars appear on the sides of the images	Camera does not output images using the full image size	In GEVPlayer, adjust the **Width**, **Height**, and image offset features until the black bars no longer appear.

Chapter 10

Reference: Mechanical Drawings and Material List

This chapter provides the mechanical drawings, and also provides a list of connectors and cables, with corresponding manufacturer details.

 Three-dimensional (3-D) mechanical drawings are available at the Pleora Technologies Support Center.

The following topics are covered in this chapter:

Mechanical Drawings

The mechanical drawings in this section provide the external frame grabber's dimensions, features, and attributes. All dimensions are in inches.

The measurements have the following tolerances, depending on the number of significant digits provided:

.X ±0.1
.XX ±0.01
.XXX ±0.005

OEM Board Set

The main board and daughter card are both 0.0625 inches thick. The maximum secondary component height on both boards is 0.08 inches, unless otherwise specified in the drawings.
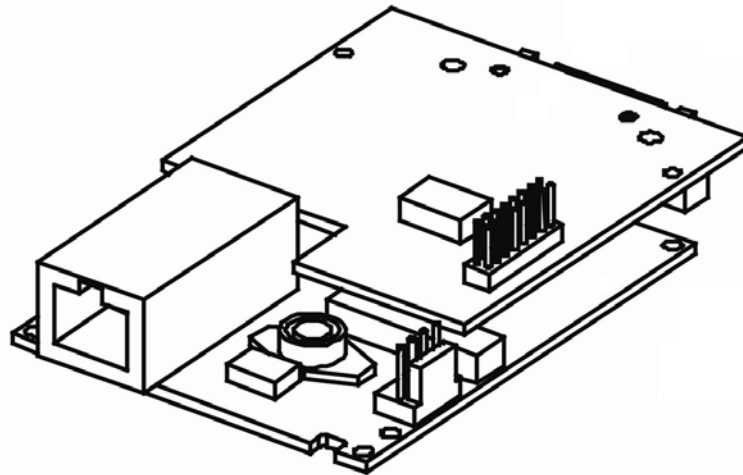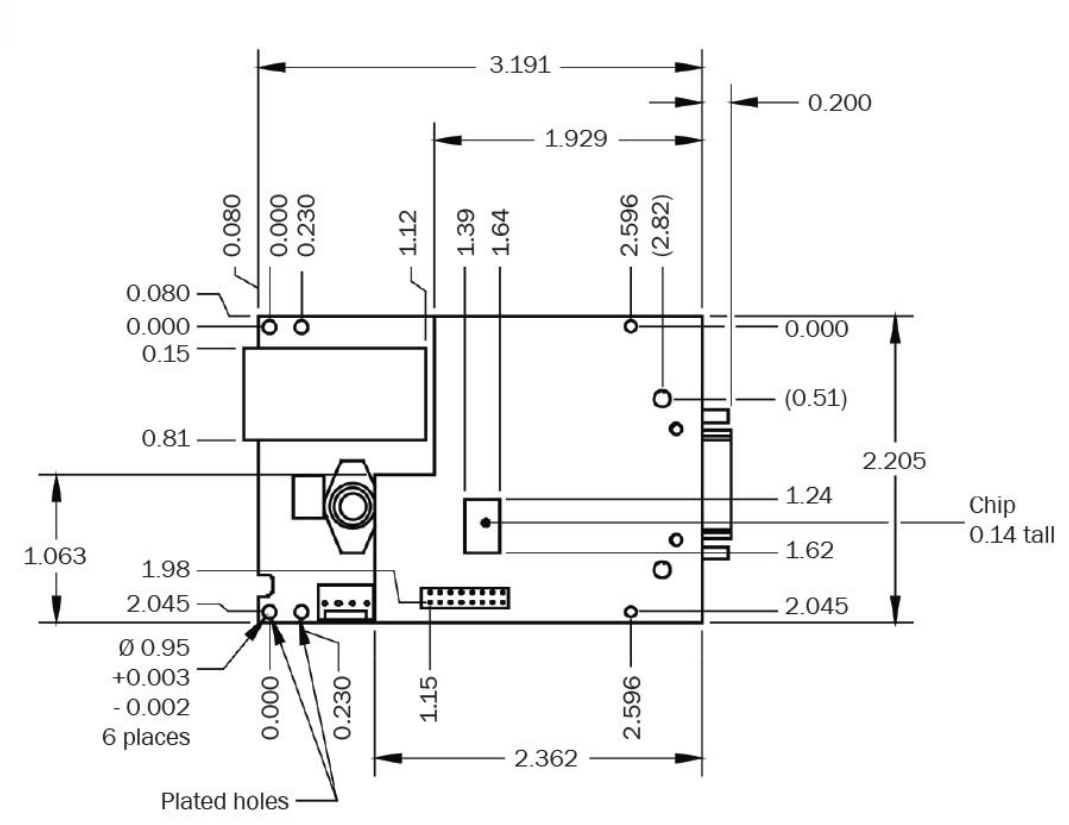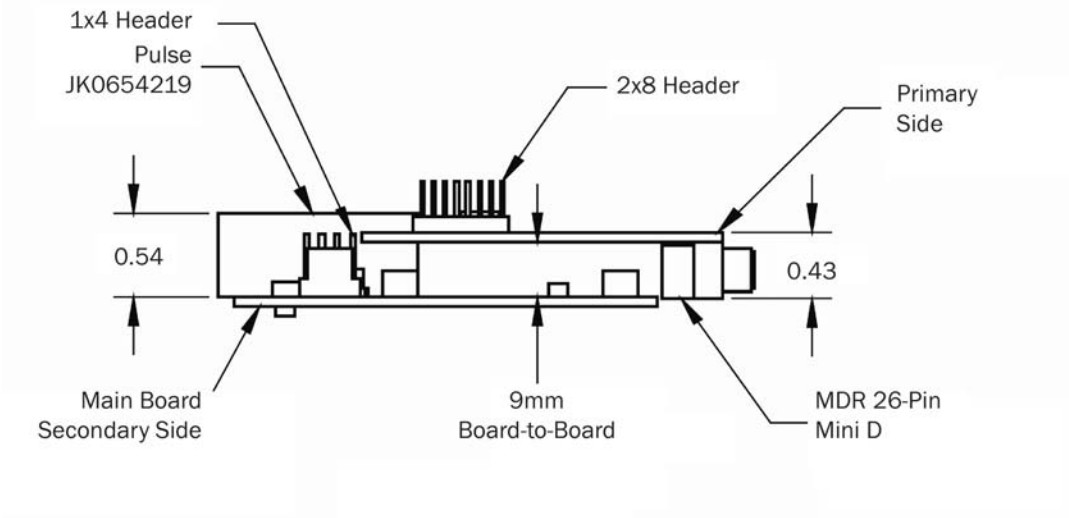
Figure 7: OEM Board Set

Figure 8: OEM Board Set

Enclosed Unit

The enclosure is made from anodized aluminum and provides four mounting holes. The mounting hole diameter and slot width are both 0.17 +/- 0.01 inches.

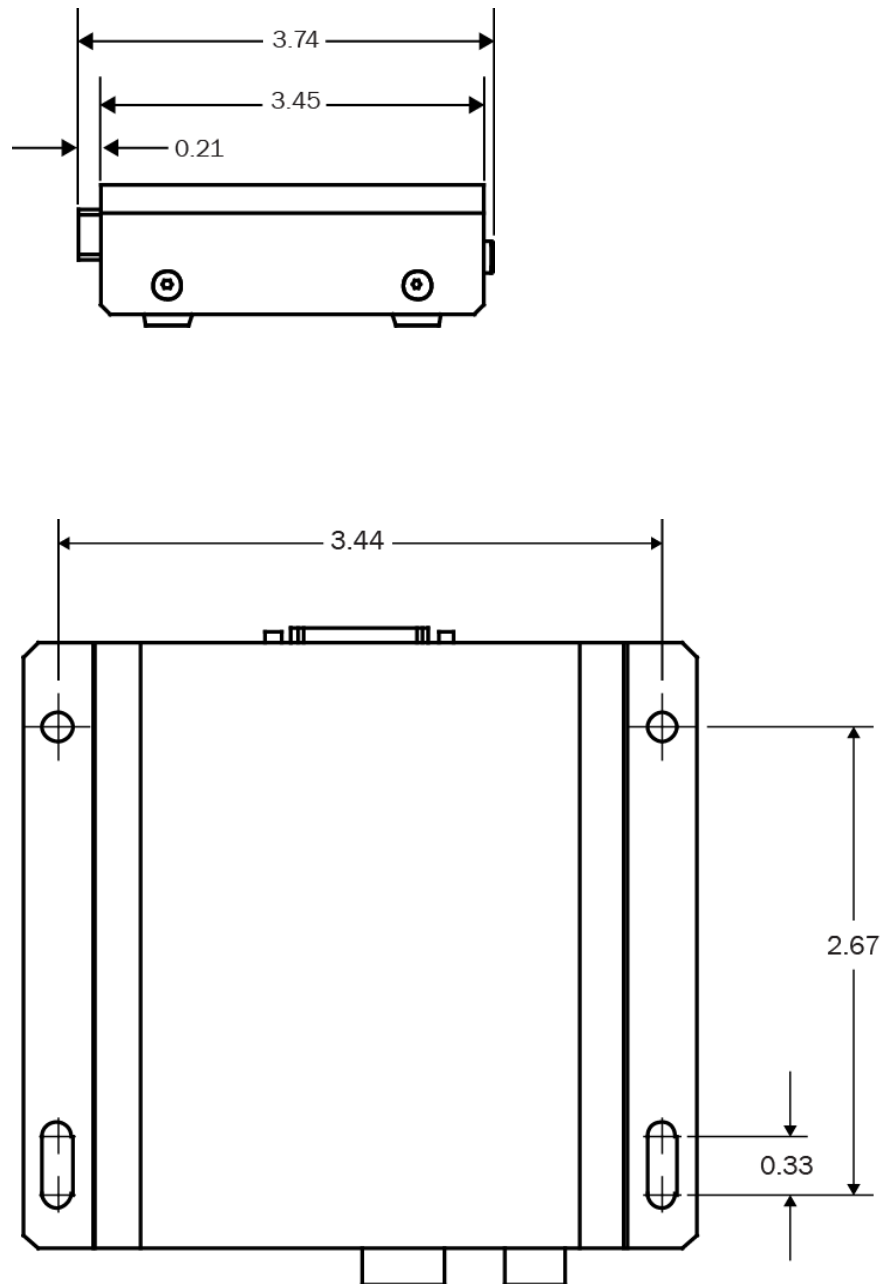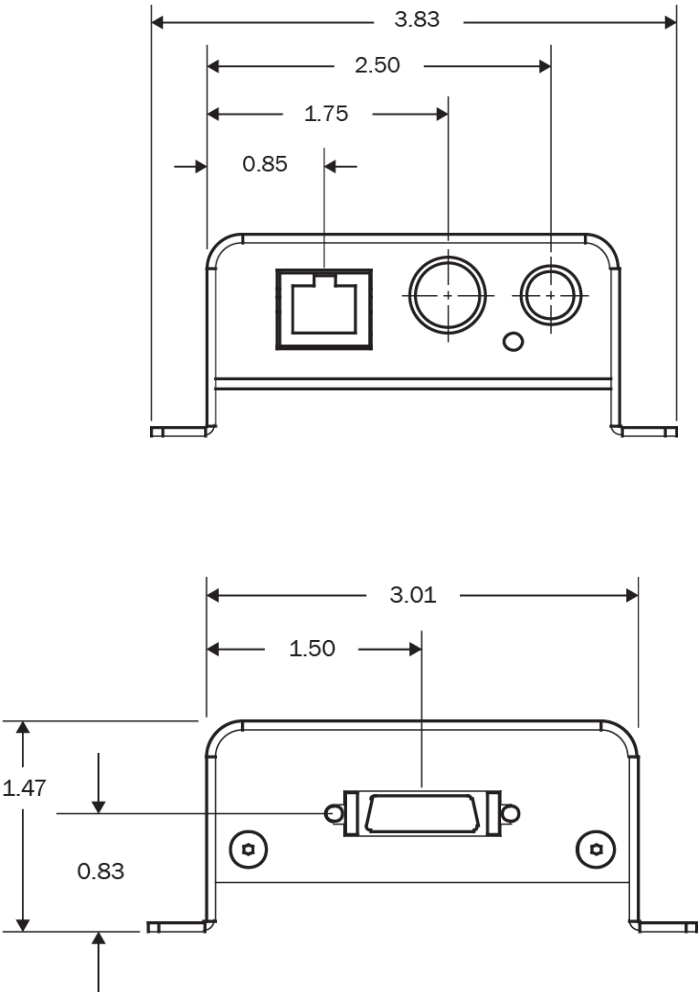Figure 9: Enclosure — Top and Side View

iPORT PT1000-CL4 External Frame Grabber User Guide

Figure 10: Enclosure — Front and Back Views

Material List

The connector summaries for the external frame grabber are listed in the following table.

Table 16: Connector Summary

ID	Location	Description	Manufacturer part number	Manufacturer
J5	Main board	RJ-45 jack, green/green LED, horizontal	JK0654219NL	Pulse
J2	Daughter card	16-pin 2 mm male header	TMM-108-01-G-D-SM	Samtec
J2	Main board	4-pin connector, 6373 series	22-23-2041	Molex
J4	Daughter card	26-pin Camera Link D-Sub Micro-D Connector	10226-1210PE	3M
Enclosed PT1000-CL4 External Frame Grabber				
6-pin circular connector, male			HR10A-7R-6P(73)	Hirose
12-pin circular connector, female			HR10A-10R-12SB(71)	Hirose
Jack socket for the MDR connector			3341-31	3M

Source manufacturer, description, and identification may vary for each connector.

Chapter 11

Technical Support

On the Pleora Support Center, you can:

- Download the latest software.
- Log a support issue.
- View documentation for current and past releases.
- Browse for solutions to problems other customers have encountered.
- Get presentations and application notes.
- Get the latest news and information about our products.
- Decide which of Pleora's products work best for you.

To visit the Pleora Support Center

- Go to www.pleora.com and click **Support Center**.

  If you have not registered yet, you are prompted to register.

  Accounts are usually validated within one business day.

If you have difficulty finding an existing solution in the knowledge base, post a question by clicking **Log a Case**. Provide as many specific details about your system and the nature of the issue as possible.